

the same as the one described above with one important difference; after the 10-minute resting baseline, the table was tilted upward at the head to 60 degrees for an additional 10 minutes before air was removed from the lower chamber.

Results showed that subjects could tolerate the supine LBNP significantly longer than the combined HUT + LBNP ( $p < 0.0004$ ) (figure 1). There were significant differences between the tests for heart rate ( $p < 0.003$ ), stroke volume ( $p < 0.04$ ), peripheral blood volume ( $p < 0.02$ ), and thoracic fluid volume ( $p < 0.016$ ). In all cases the magnitude of physiological changes from baseline were much greater for the HUT + LBNP than for supine LBNP, that is, higher stress levels than the supine LBNP. The HUT + LBNP can be used to reliably induce presyncope in men; however, data suggest that this device, as used in the present study, produces too strong a stimulus for testing countermeasures when used with normotensive subjects.

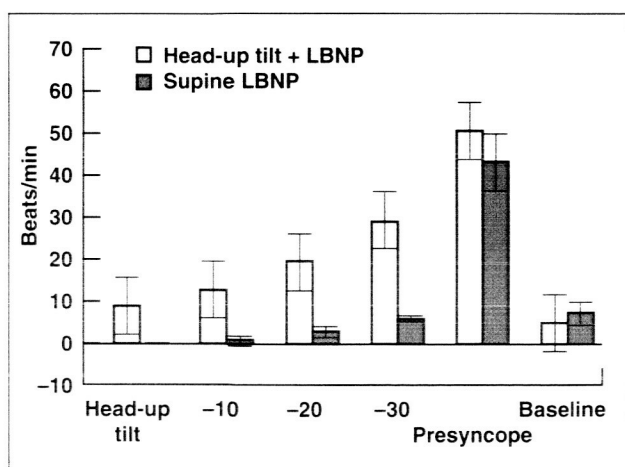


Fig. 1. Heart rate expressed as mean changes from pretest baseline during supine LBNP alone and 60-degree HUT combined with LBNP ( $N = 8$ ). The x-axis depicts HUT, -10 mm Hg, -20 mm Hg, -30 mm Hg, presyncope (just prior to fainting), and the return to supine during posttest baseline.

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## FUNDAMENTAL SCIENCE

### Synaptogenesis in Microgravity (NIH.B1)

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The flight experiment National Institutes of Health.Biology 1 (NIH.B1) was flown on the space transport system (STS-93) in late July, 1999. NASA Ames Research Center collaborated with BioServe Space Technologies, a NASA-sponsored Commercial Space Center (CSC), to develop an enhancement to the Group Activation Package (GAP) and the Isothermal Containment Module (ICM), shown in the first figure, flown within the Commercial Generic BioProcessing Apparatus (CGBA) payload. The collaboration evolved from the needs of both organizations to fly middeck experiments on the STS-93 mission. The NIH.B1 experiment was entitled "Effects of Spaceflight on *Drosophila* Neural Development," and was led by Principal Investigator, Haig Keshishian, Harvard. This experiment was designed to investigate the effects of microgravity on a transgenic fruit fly line that expresses green fluorescent protein (GFP) to visualize singly identified motoneurons and their muscle targets, as shown in the second figure.

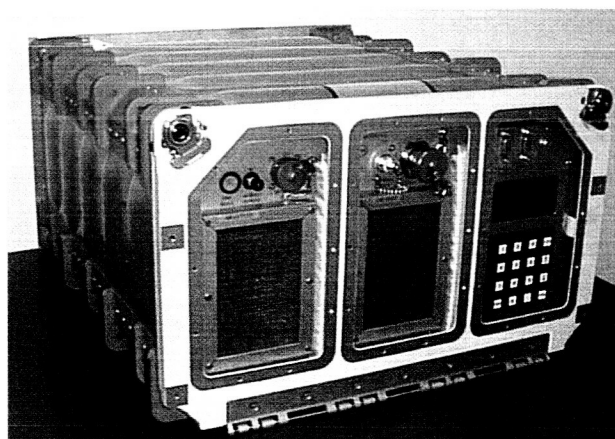
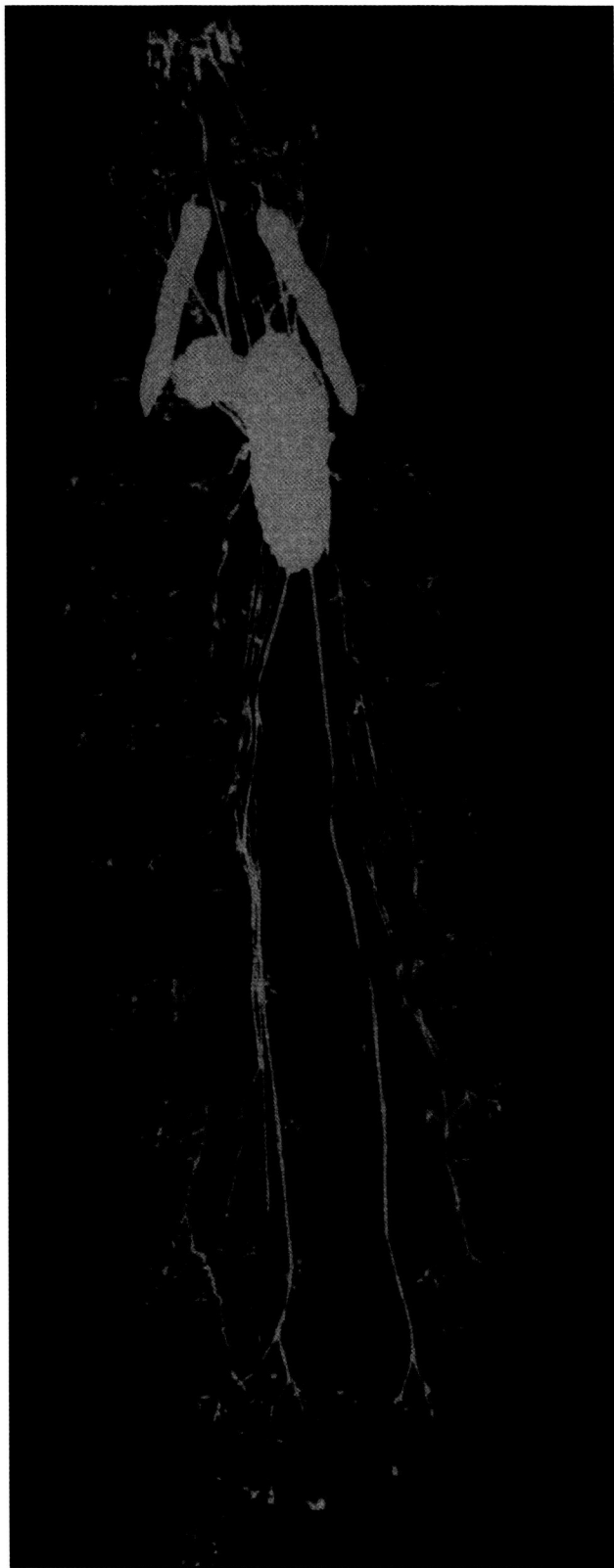


Fig. 1. The Isothermal Containment Module (ICM) used in STS-93.



*Fig. 2. Drosophila fruit fly with fluorescent marker.*

*Drosophila* embryo development can be suspended and resumed by temperature shifts. The flight experiment design made it possible to accurately control and examine discrete developmental exposures covering critical times in the differentiation of the motor neurons. A mix of embryos and larvae at specific developmental stages were prepared by the investigator before the flight. Specimens were launched at 11 degrees Centigrade (°C). During flight, the temperature was elevated to 25 °C for a specific duration, which allowed development, and then returned to 11 °C after a preselected time period and prior to landing. This scenario stopped developmental activities or "froze" development in time. In this manner, the experiment could definitely correlate happenings at microgravity versus happenings at unit gravity. Unfortunately, there were electrical problems encountered with the startup of the BioServe ICM unit in the shuttle, and the experiment was unsuccessful because it could not proceed through the designated temperature regimens. This experiment is scheduled for a reflight with a newly upgraded ICM unit in late summer 2000.

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